

031520-24

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CERTIFICATE

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IDENTIFIED INTERNATIONAL APPLICATION THAT WAS FILED WITH THE
CHINESE PATENT OFFICE AS RECEIVING OFFICE

国际申请号: PCT/CN03/00555

INTERNATIONAL APPLICATION NUMBER

国际申请日: 14 JULY 2003 (14.07.03)

INTERNATIONAL FILING DATE

发明名称: SYSTEM AND METHOD FOR IMPROVING THE ELECTRICAL

TITLE OF INVENTION

CONNECTION OF A HARD DRIVE RELAY FLEXIBLE

CIRCUIT ASSEMBLY TO AN HGA FLEXURE CABLE

申请人: SAE MAGNETICS(H.K.)LTD

APPLICANT



中华人民共和国国家知识产权局局长

COMMISSIONER OF THE STATE INTELLECTUAL PROPERTY

OFFICE OF THE PEOPLE'S REPUBLIC OF CHINA

王荣川

二零零三年八月八日

AUGUST 08, 2003

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

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International Application No.

PCT/CN 03/00555

International Filing Date

14 JUL 2003
(14.07.03)

Name of receiving Office and PCT International Application No.

RO/CN 中华人民共和国国家知识产权局
PCT International Application No.Applicant's or agent's file reference
(if desired) (12 characters maximum)

FPEL03150024

Box No. I TITLE OF INVENTION

SYSTEM AND METHOD FOR IMPROVING THE ELECTRICAL CONNECTION OF A HARD DRIVE RELAY FLEXIBLE CIRCUIT ASSEMBLY TO AN HGA FLEXURE CABLE

Box No. II APPLICANT

☐ This person is also inventor

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☒ all designated
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☐ all designated States except
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☐ the United States
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☐ the States indicated in
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Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

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☐ applicant and inventor

☒ inventor only (If this check-box
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☐ all designated States except
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Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common
representative

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Sheet No. ... 2 ...

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

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☒ inventor only (If this check-box is marked, do not fill in below.)

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Applicant's registration No. with the Office

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State (that is, country) of residence:

This person is applicant for the purposes of:

☐ all designated States☐ all designated States except the United States of America☐ the United States of America only☐ the States indicated in the Supplemental Box☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Sheet No. 3

Box No. V DESIGNATION OF STATES

Mark the applicable check-boxes below; at least one must be marked.

The following designations are hereby made under Rule 4.9(a):

Regional Patent

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| <input type="checkbox"/> CO Colombia | <input type="checkbox"/> LT Lithuania | <input type="checkbox"/> TM Turkmenistan |
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☐ ☐ ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

Sheet No. ...4...

Box No. VI PRIORITY CLAIM

The priority of the following earlier application(s) is hereby claimed:

| Filing date of earlier application (day/month/year) | Number of earlier application | Where earlier application is: | | |
|---|----------------------------------|--|---|--|
| | | national application: country or Member of WTO | regional application:* regional Office | international application: receiving Office |
| item (1) | | | | |
| item (2) | | | | |
| item (3) | | | | |
| item (4) | | | | |
| item (5) | | | | |

☐ Further priority claims are indicated in the Supplemental Box.

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office) identified above as:

☐ all items ☐ item (1) ☐ item (2) ☐ item (3) ☐ item (4) ☐ item (5) ☐ other, see Supplemental Box

* Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)):

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / CN

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number


Country (or regional Office)

Box No. VIII DECLARATIONS

The following declarations are contained in Boxes Nos. VIII (i) to (v) (mark the applicable check-boxes below and indicate in the right column the number of each type of declaration):

Number of
declarations

- | | | |
|---|--|---|
| <input type="checkbox"/> Box No. VIII (i) | Declaration as to the identity of the inventor | : |
| <input type="checkbox"/> Box No. VIII (ii) | Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent | : |
| <input type="checkbox"/> Box No. VIII (iii) | Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application | : |
| <input type="checkbox"/> Box No. VIII (iv) | Declaration of inventorship (only for the purposes of the designation of the United States of America) | : |
| <input type="checkbox"/> Box No. VIII (v) | Declaration as to non-prejudicial disclosures or exceptions to lack of novelty | : |

| Box No. IX CHECK LIST; LANGUAGE OF FILING | | |
|--|--|------------------------|
| <p>This international application contains:</p> <p>(a) in paper form, the following number of sheets:</p> <p style="padding-left: 20px;">request (including declaration sheets) : 5</p> <p style="padding-left: 20px;">description (excluding sequence listings and/or tables related thereto) : 5</p> <p style="padding-left: 20px;">claims : 4</p> <p style="padding-left: 20px;">abstract : 1</p> <p style="padding-left: 20px;">drawings : 10</p> <p style="padding-left: 20px;">Sub-total number of sheets : 25</p> <p style="padding-left: 20px;">sequence listings</p> <p style="padding-left: 20px;">tables related thereto</p> <p style="padding-left: 20px;"><i>(for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below)</i></p> <p style="padding-left: 20px;">Total number of sheets : 25</p> <p>(b) <input type="checkbox"/> only in computer readable form (Section 801(a)(i))</p> <p style="padding-left: 20px;">(i) <input type="checkbox"/> sequence listings</p> <p style="padding-left: 20px;">(ii) <input type="checkbox"/> tables related thereto</p> <p>(c) <input type="checkbox"/> also in computer readable form (Section 801(a)(ii))</p> <p style="padding-left: 20px;">(i) <input type="checkbox"/> sequence listings</p> <p style="padding-left: 20px;">(ii) <input type="checkbox"/> tables related thereto</p> <p>Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the</p> <p><input type="checkbox"/> sequence listings:</p> <p><input type="checkbox"/> tables related thereto:</p> <p><i>(additional copies to be indicated under items 9(ii) and/or 10(ii), in right column)</i></p> | <p>This international application is accompanied by the following item(s) (mark the applicable check-boxes below and indicate in right column the number of each item):</p> <p>1. <input checked="" type="checkbox"/> fee calculation sheet : 1</p> <p>2. <input checked="" type="checkbox"/> original separate power of attorney :</p> <p>3. <input type="checkbox"/> original general power of attorney :</p> <p>4. <input type="checkbox"/> copy of general power of attorney; reference number, if any:</p> <p>5. <input type="checkbox"/> statement explaining lack of signature :</p> <p>6. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s):</p> <p>7. <input type="checkbox"/> translation of international application into (language):</p> <p>8. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material :</p> <p>9. <input type="checkbox"/> sequence listings in computer readable form (indicate type and number of carriers)</p> <p style="padding-left: 20px;">(i) <input type="checkbox"/> copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) :</p> <p style="padding-left: 20px;">(ii) <input type="checkbox"/> (only where check-box (b)(i) or (c)(i) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter :</p> <p style="padding-left: 20px;">(iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the sequence listings mentioned in left column :</p> <p>10. <input type="checkbox"/> tables in computer readable form related to sequence listings (indicate type and number of carriers)</p> <p style="padding-left: 20px;">(i) <input type="checkbox"/> copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application) :</p> <p style="padding-left: 20px;">(ii) <input type="checkbox"/> (only where check-box (b)(ii) or (c)(ii) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater) :</p> <p style="padding-left: 20px;">(iii) <input type="checkbox"/> together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column :</p> <p>11. <input type="checkbox"/> other (specify):</p> | <p>Number of items</p> |
| <p>Figure of the drawings which should accompany the abstract: Fig 5</p> | <p>Language of filing of the international application: EN</p> | |
| <p>Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE</p> <p><i>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</i></p> <div style="text-align: center; margin-top: 20px;">  </div> | | |

| For receiving Office use only | |
|--|---|
| <p>1. Date of actual receipt of the purported international application: 14 JUL 2003 (14.07.03)</p> | <p>2. Drawings:</p> <p><input type="checkbox"/> received:</p> <p><input type="checkbox"/> not received:</p> |
| <p>3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:</p> | <p>6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid</p> |
| <p>4. Date of timely receipt of the required corrections under PCT Article 11(2):</p> | |
| <p>5. International Searching Authority (if two or more are competent): ISA /</p> | |

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FEE CALCULATION SHEET
Annex to the Request

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International Application No. PCT/CN 03/00555

14 JUL 2003

Date stamp of the receiving Office

(14.07.03)

Applicant's or agent's
file reference

FPEL03150024

Applicant

SAE MAGNETICS (H.K.) LTD.

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE

CNY500

T

2. SEARCH FEE

CNY1500

S

International search to be carried out by

(If two or more International Searching Authorities are competent to carry out the international search, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

Where items (b) and/or (c) of Box No. IX apply, enter Sub-total number of sheets } 25
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b1 first 30 sheets CHF650 b1

b2 number of sheets in excess of 30 x fee per sheet = b2

b3 additional component (only if sequence listings and/or tables related thereto are filed in computer readable form under Section 801(a)(i), or both in that form and on paper, under Section 801(a)(ii):

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Designation Fees

The international application contains 1 designations.

1 x CHF140 = CHF790 D
number of designation fees payable (maximum 5) amount of designation fee

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(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable) P

5. TOTAL FEES PAYABLE

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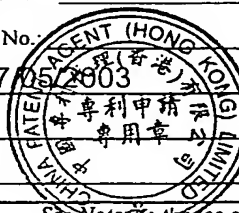
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**SYSTEM AND METHOD FOR IMPROVING THE
ELECTRICAL CONNECTION OF A HARD DRIVE RELAY
FLEXIBLE CIRCUIT ASSEMBLY TO AN HGA FLEXURE CABLE**

5 Background Information

[0001] The present invention relates to hard disk drives. More specifically, the invention relates to a system and method for improving the electrical connection of a hard drive relay flexible circuit assembly to a head-gimbal assembly (HGA) flexure cable.

10 [0002] Figure 1 provides an illustration of a typical hard disk drive. Hard disk drive storage devices typically include a rotating disk 1 mounted for rotation by a spindle motor 2. A slider 3, supported by an actuator arm 5, 'flies' over the surface of the magnetic disk 1 at a high velocity reading data from and writing data to concentric data tracks on the disk 1. The slider 3 is positioned radially by a
15 voice coil 7 embedded in a voice coil carriage 8.

[0003] In typical hard disk drives, electrical control signals are communicated to the voice coil 7 by a relay flexible circuit 9. Typically, the relay flexible circuit 9 also communicates read/write data to the slider/head(s) 3. A printed circuit board (PCB) 11 operates to control the position of the arm(s) 5 with head/slider(s) 3 (also
20 known as the head stack assembly (HSA)).

[0004] Figure 2 shows a more detailed view of a head stack assembly (HSA) typical in the art. The actuator arm 5 is mounted on the actuator assembly (not shown) and affixed to a pivot member 6. The actuator arms 5 each have a suspension flexure cable (HGA flexure cable) 20 running from the heads/sliders 3
25 to a plurality connecting pads 19. The connecting pads 19 are electrically coupled to the flexible circuit assembly 9 by bonding (e.g., by solder bump or gold ball bonding 15) the flexure cable connecting pads 19 to a plurality of flexible circuit bonding pads 16.

[0005] Figure 3 provides a more detailed illustration of the voice coil actuator
30 assembly as is typical in the art. A relay flexible circuit 9 is aligned upon the coil

carriage 8 by an alignment pin 17 protruding from the coil carriage 8 (inserted in a hole in a circuit board 14 terminating the flexible circuit assembly 9). After positioning, the flexible circuit assembly 9 may be electrically coupled to the HGA (not shown), as illustrated in Figures 2 and 4.

5 [0006] Figure 4 illustrates electrically coupling the HGA flexure cable connecting pads to flexible circuit bonding pads as is typical in the art. Typically, bonding methods 15, such as solder bump or gold ball bonding, are utilized to electrically couple the HGA flexure cable connecting pads 19 to the flexible circuit bonding pads 16. As stated above, an alignment pin 17 is utilized to position the circuit
10 board 14 of the relay flexible circuit assembly (not shown). As stated above, the circuit board 14 bonding pads 16 are electrically coupled to the flexure cable connecting pads 19 by methods such as solder bump or gold ball bonding 15.

[0007] Because this design requires the electrical bonds 15 to be placed on the inside corners formed by the extended plates 18 of the HGA flexure cable (not
15 shown) and the circuit board 14, it is difficult to create the bonds. It is a very limited space in which to operate. The alignment of the pads 16,18 and their electrical coupling is a great challenge. The quality and efficiency of the process is adversely affected by this challenge. The tooling and equipment costs can be great because of this. In addition, a problem with soldering the electrical
20 connection 15 between the pads 16,18 is that the bonds must be cleaned immediately after soldering. Soldering flux, which is necessary for effective soldering, must be removed. Removing the flux can be difficult and costly. Solder, which consists primarily of tin, can cause component contamination. During soldering, tin may splash out, causing damage to surrounding electrical
25 components and/or disk media.

[0008] It is therefore desirable to have a system and method for improving the electrical connection of a hard drive relay flexible circuit assembly to a head-gimbal assembly (HGA) flexure cable that avoids the above-mentioned problems, as well as having additional benefits.

Brief Description Of The Drawings

[0009] Figure 1 provides an illustration of a typical hard disk drive.

[0010] Figure 2 shows a more detailed view of a head stack assembly (HSA) typical in the art.

5 [0011] Figure 3 provides a more detailed illustration of the voice coil actuator assembly as is typical in the art.

[0012] Figure 4 illustrates electrically coupling the head-gimbal assembly HGA flexure cable connecting pads to flexible circuit bonding pads as is typical in the art.

10 [0013] Figure 5 illustrates a head-gimbal assembly (HGA) with a U-shaped relay flexible circuit-to-flexure cable connector according to an embodiment of the present invention.

[0014] Figure 6 provides an illustration of the voice coil actuator assembly (without the flexure cables or arms attached) according to an embodiment of the present invention.

15 [0015] Figure 7 illustrates the attachment of a U-shaped connector for a relay flexible cable to a coil carriage according to an embodiment of the present invention.

[0016] Figure 8 illustrates a detailed illustration of the relay flexible circuit according to an embodiment of the present invention.

20 [0017] Figure 9 provides an illustration of the attachment of a relay flexible circuit to a U-shaped connector and the attachment of the connector to a coil carriage according to an embodiment of the present invention.

[0018] Figure 10 illustrates the electrical coupling of bonding pads on the relay flexible circuit to connector pads on the HGA flexure cable according to an embodiment of the present invention.

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Detailed Description

[0019] Figure 5 illustrates a head-gimbal assembly (HGA) with a U-shaped relay flexible circuit-to-flexure cable connector according to an embodiment of the present invention. In one embodiment, a U-shaped connector 21 is seated to a portion of the coil carriage 8 (as explained below with respect to Figure 6). The U-shaped connector 21 is assured correct positioning by one or more alignment pins 17. In this embodiment, pads (not shown) on each of the extended plates 18 of the flexure cables are bonded to pads (not shown) on the top/bottom of the connector 21 (described below).

[0020] Figure 6 provides an illustration of the voice coil actuator assembly (without the flexure cables or arms attached) according to an embodiment of the present invention. In one embodiment, the U-shaped connector 21, which is attached to the relay flexible cable 9, is coupled to the coil carriage 8. In this embodiment, the connector 21 is placed over a portion of the coil carriage 8, where opposing tabs 25 on opposite sides of the connector 21 seat into grooves 23 located on the top and bottom of the coil carriage 8 (as described in Figure 7).

[0021] Figure 7 illustrates the attachment of a U-shaped connector for a relay flexible cable to a coil carriage according to an embodiment of the present invention. In one embodiment, as stated above, the connector 21 is placed over the coil carriage 8. In this embodiment, opposing tabs 25 on the connector 21 are shaped and located to seat in grooves 23 on the top and bottom of the coil carriage 8. In this embodiment, alignment pins 17 on the coil carriage 8 fit into alignment holes 30 on the connector 21 to assure proper positioning.

[0022] Figure 8 illustrates a detailed illustration of the relay flexible circuit according to an embodiment of the present invention. In one embodiment, the relay flexible circuit 9 is attached to the connector 21 by epoxy 31 (further described below).

[0023] Figure 9 provides an illustration of the attachment of a relay flexible circuit to a U-shaped connector and the attachment of the connector to a coil carriage according to an embodiment of the present invention. In one embodiment, as explained above, the relay flexible circuit 9 is attached to the U-shaped connector 21 by epoxy. In this embodiment, bonding pads 16 on the relay flexible circuit 9 are covered with an electrically conductive film 24, such as Anisotropic Conductive Film (ACF). The film 24, which in one embodiment is tacky, adheres to the pads 16.

[0024] Figure 10 illustrates the electrical coupling of bonding pads on the relay flexible circuit to connector pads on the HGA flexure cable according to an embodiment of the present invention. In one embodiment, the conductive film 24, which is adhered to the bonding pads 16 is pressed against the connecting pads 19 of the flexure cable extended plates 18. In this embodiment, after positioning the flexure cable extended plates 18, the pads 16,18 are bonded. In this embodiment, a heated bonding tip 32 is pressed against the extended plate 18. The tip 32 heats and compresses the conductive film 24 to bring about the curing process.

[0025] Although several embodiments are specifically illustrated and described herein, it will be appreciated that modifications and variations of the present invention are covered by the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

What is claimed is

1. A system for manufacturing a hard disk drive arm comprising:

a U-shaped connector to couple a relay flexible cable to a voice coil carriage
5 assembly, said U-shaped connector including a plurality of generally parallel plates,
wherein

said parallel plates include at least one bonding pad to electrically couple said
relay flexible cable to a head gimbal assembly (HGA) flexure cable.

(10 2. The system of claim 1, wherein said parallel plates include a plurality of
opposing tabs.

3. The system of claim 2, wherein said voice coil carriage assembly has a plurality
of grooves, said grooves being located on opposite sides of the voice coil carriage
15 assembly.

4. The system of claim 3, wherein said grooves are shaped and located to accept
said tabs.

(20 5. The system of claim 1, wherein said U-shaped connector includes at least one
alignment hole and said voice coil carriage assembly includes at least one
alignment pin, said alignment hole shaped and located to accept said alignment pin.

6. The system of claim 1, wherein said bonding pad is to be coupled to at least one
25 connecting pad on said HGA flexure cable by a conductive bonding agent.

7. The system of claim 6, wherein said bonding agent includes a plurality of
electrically conductive particles.

8. The system of claim 7, wherein said bonding agent is to be compressed between said bonding pad and said connector pad, a number of said particles to form an electrical path between said bonding pad and said connector pad.

5 9. The system of claim 8, wherein said bonding agent is Anisotropic Conductive Film (ACF).

10. The system of claim 1, wherein said voice coil carriage assembly is molded polymer resin.

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11. The system of claim 1, wherein said voice coil carriage assembly is stamped aluminum.

12. The system of claim 1, wherein said U-shaped connector has four bonding pads
15 and said HGA flexure cable has four connecting pads.

13. The system of claim 12, wherein said bonding pads and said connecting pads are gold coated.

20 14. A method for manufacturing a hard disk drive arm comprising:

coupling, by a U-shaped connector, a relay flexible cable to a voice coil carriage assembly, said U-shaped connector including a plurality of generally parallel plates and said parallel plates including at least one bonding pad to electrically couple said relay flexible cable to a head gimbal assembly (HGA)
25 flexure cable.

15. The method of claim 14, wherein said parallel plates include a plurality of opposing tabs.

16. The method of claim 15, wherein said voice coil carriage assembly has a plurality of grooves, said grooves being located on opposite sides of the voice coil carriage assembly.

5 17. The method of claim 16, wherein said grooves are shaped and located to accept said tabs.

18. The method of claim 14, wherein said U-shaped connector includes at least one alignment hole and said voice coil carriage assembly includes at least one
(10 alignment pin, said alignment hole shaped and located to accept said alignment pin.

19. The method of claim 14, wherein said bonding pad is to be coupled to at least one connecting pad on said HGA flexure cable by a conductive bonding agent.

15 20. The method of claim 19, wherein said bonding agent includes a plurality of electrically conductive particles.

21. The method of claim 20, wherein said bonding agent is to be compressed between said bonding pad and said connector pad, a number of said particles to
(20 form an electrical path between said bonding pad and said connector pad.

22. The method of claim 21, wherein said bonding agent is Anisotropic Conductive Film (ACF).

25 23. The method of claim 14, wherein said voice coil carriage assembly is molded polymer resin.

24. The method of claim 14, wherein said voice coil carriage assembly is stamped aluminum.

25. The method of claim 14, wherein said U-shaped connector has four bonding pads and said HGA flexure cable has four connecting pads.

5 26. The method of claim 25, wherein said bonding pads and said connecting pads are gold coated.

27. A system for manufacturing a hard disk drive arm comprising:

(10 a U-shaped connector to couple a relay flexible cable to a voice coil carriage assembly, said U-shaped connector including a plurality of generally parallel plates, said parallel plates including a plurality of opposing tabs, wherein

said voice coil carriage assembly has a plurality of grooves shaped and located to accept said tabs; and

15 said parallel plates include at least one bonding pad to electrically couple said relay flexible cable to a head gimbal assembly (HGA) flexure cable.

28. The system of claim 27, wherein said U-shaped connector includes at least one alignment hole and said voice coil carriage assembly includes at least one alignment pin, said alignment hole shaped and located to accept said alignment pin.

(20

29. The system of claim 27, wherein said bonding pad is to be coupled to at least one connecting pad on said HGA flexure cable by a conductive bonding agent.

25 30. The system of claim 29, wherein said bonding agent is Anisotropic Conductive Film (ACF).

Abstract

A system and method are disclosed for improving the electrical connection of a hard drive relay flexible circuit assembly to a head-gimbal assembly (HGA) flexure cable. In one embodiment, a flexible circuit assembly is attached to a
5 hard drive coil carriage via a U-shaped connector and is electrically coupled to the HGA flexure cable by a bonding agent, such as an Anisotropic Conductive Film (ACF).

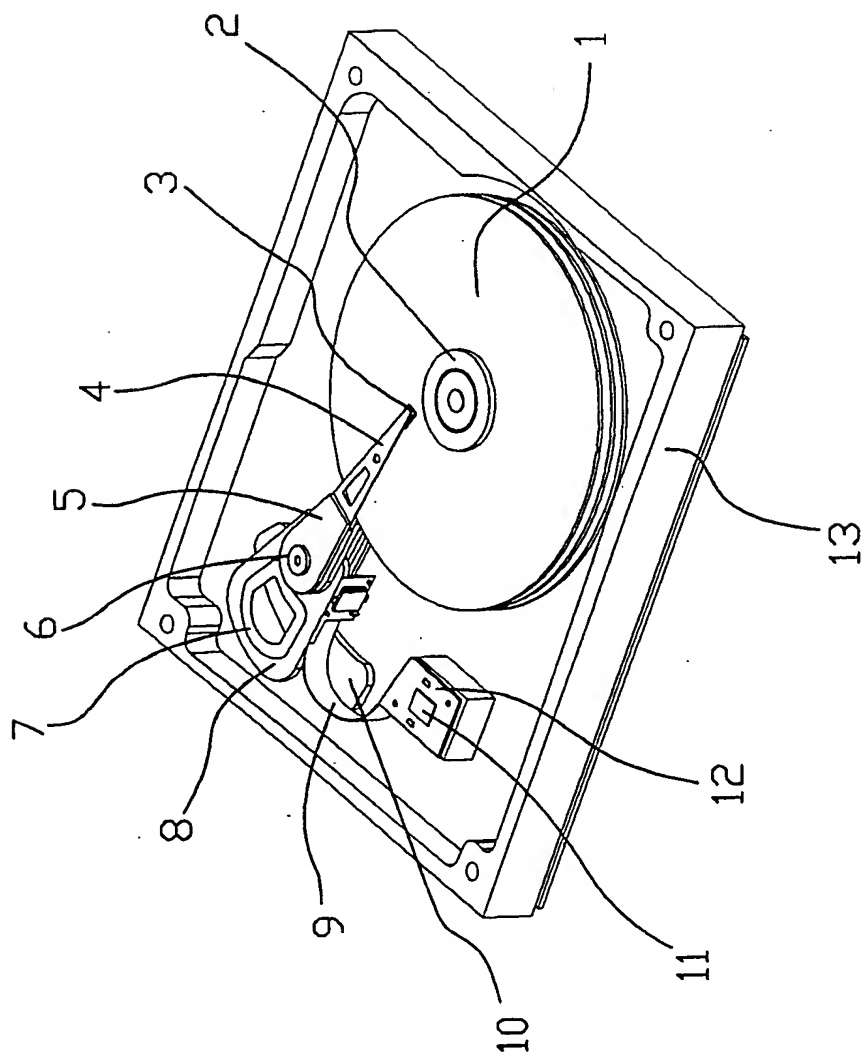


FIG. 1
(Prior Art)

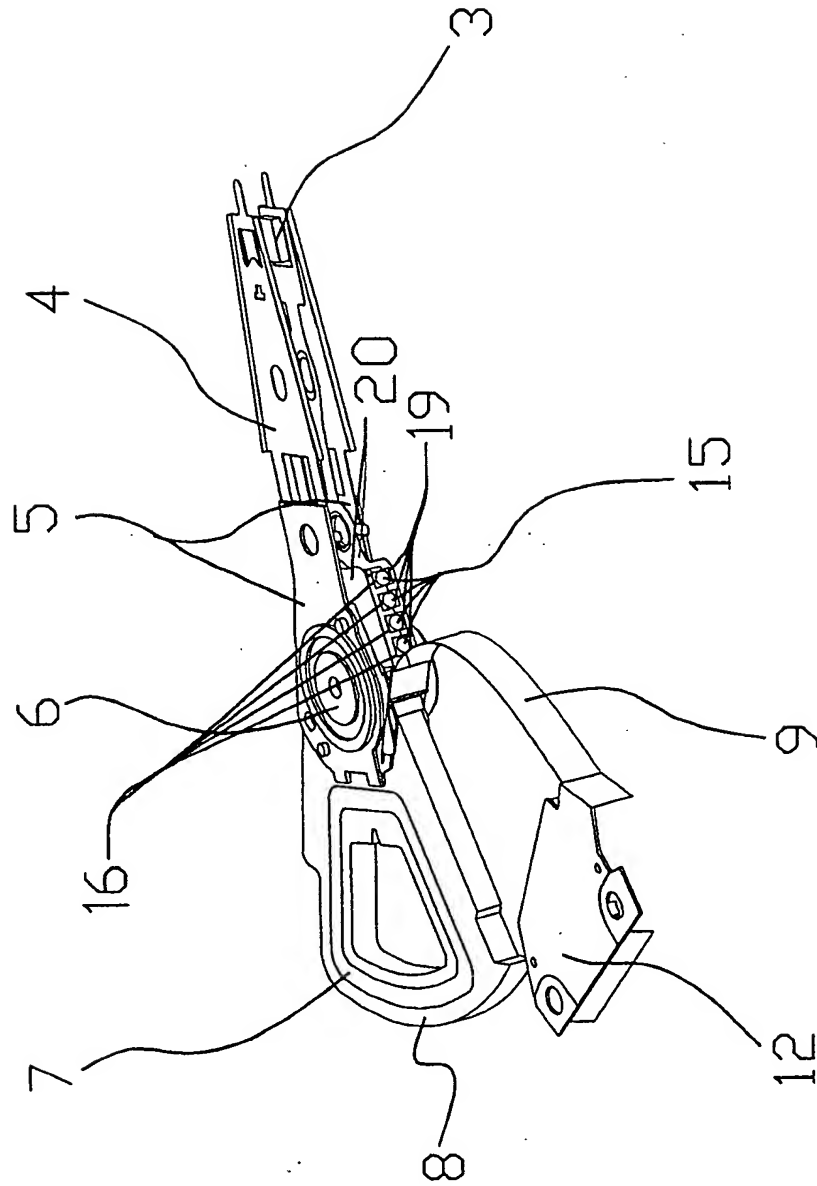


FIG. 2
(Prior Art)

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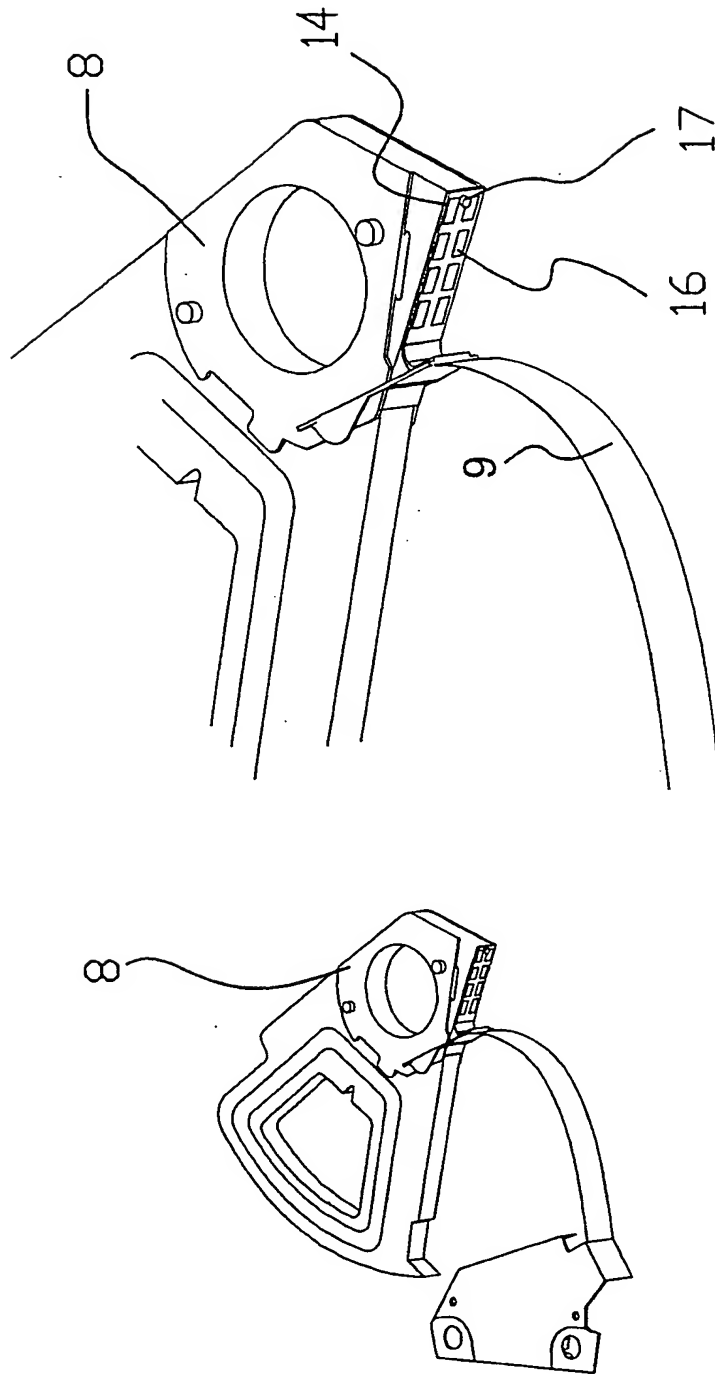


FIG. 3
(Prior Art)

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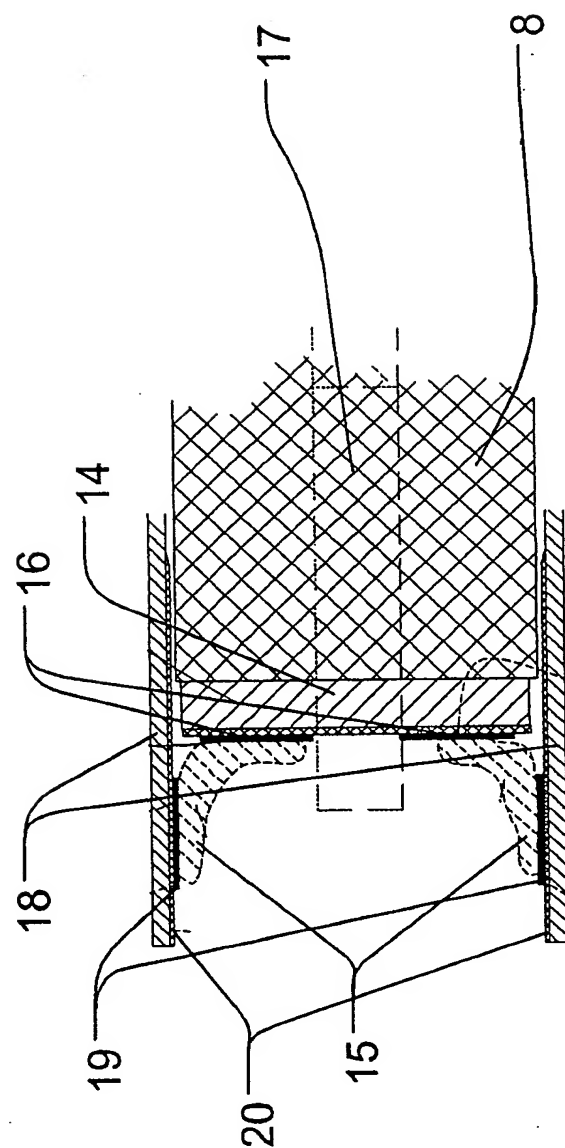


FIG. 4
(Prior Art)

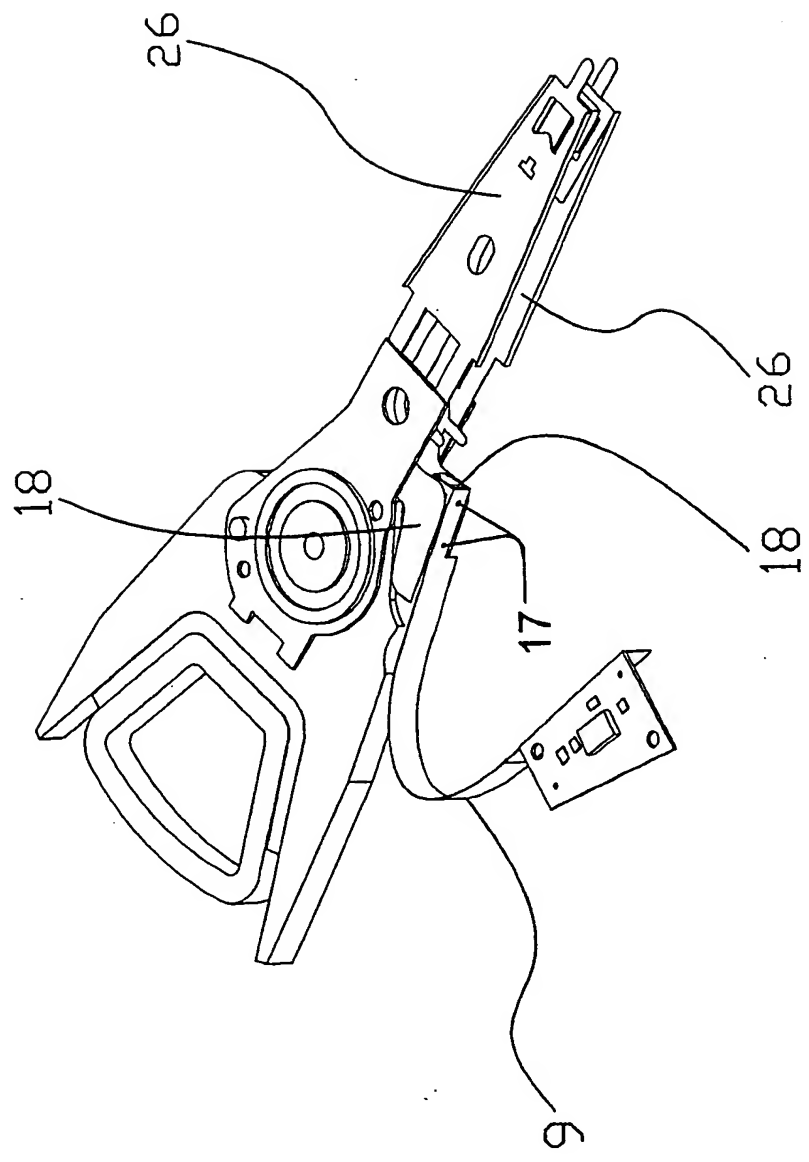


FIG. 5

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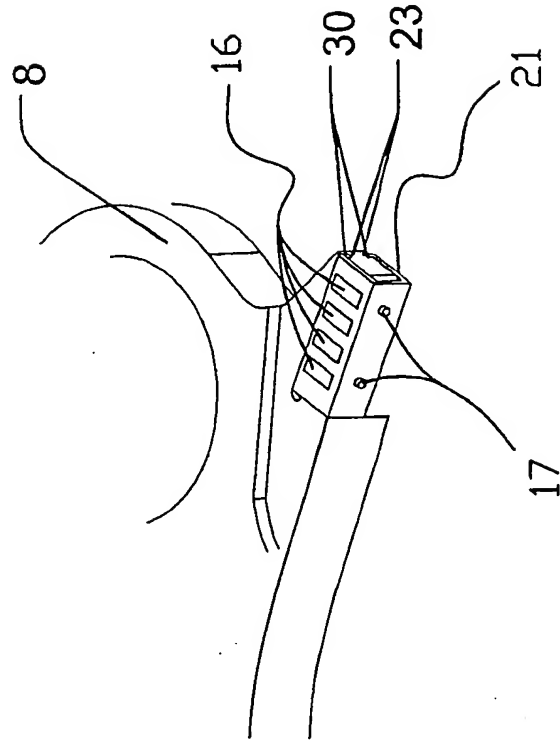
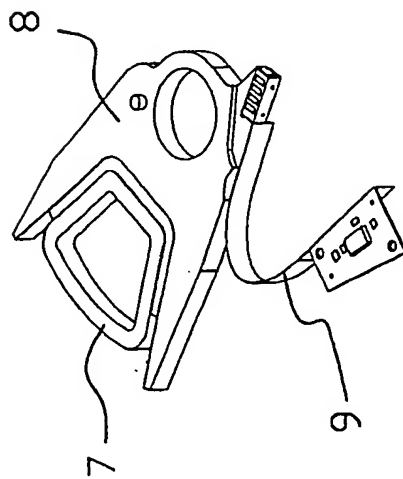


FIG. 6



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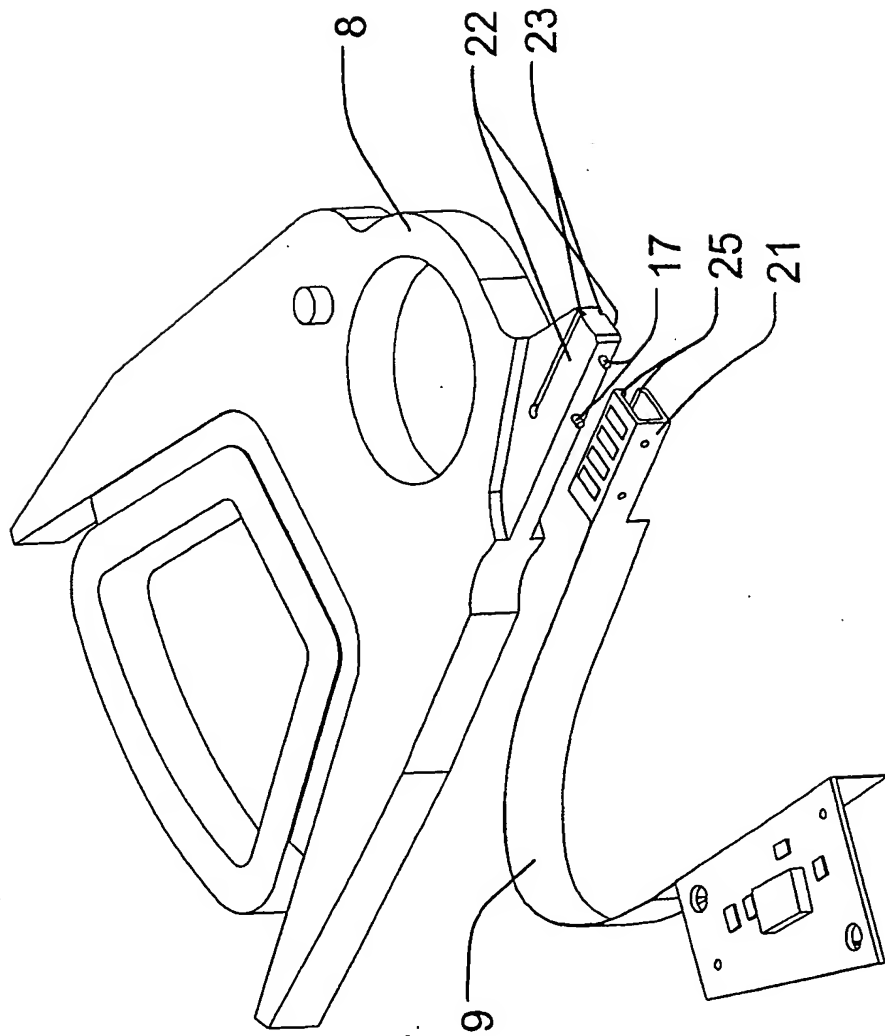


FIG. 7

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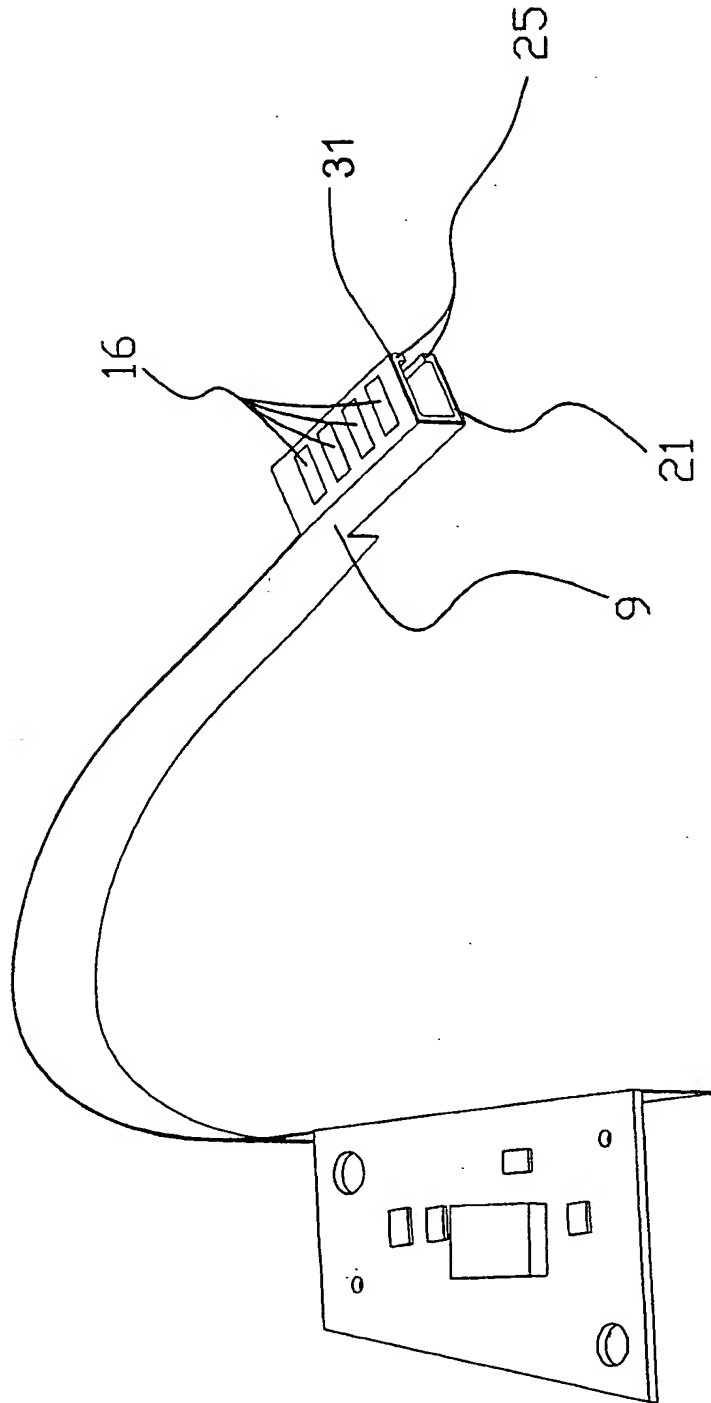


FIG. 8

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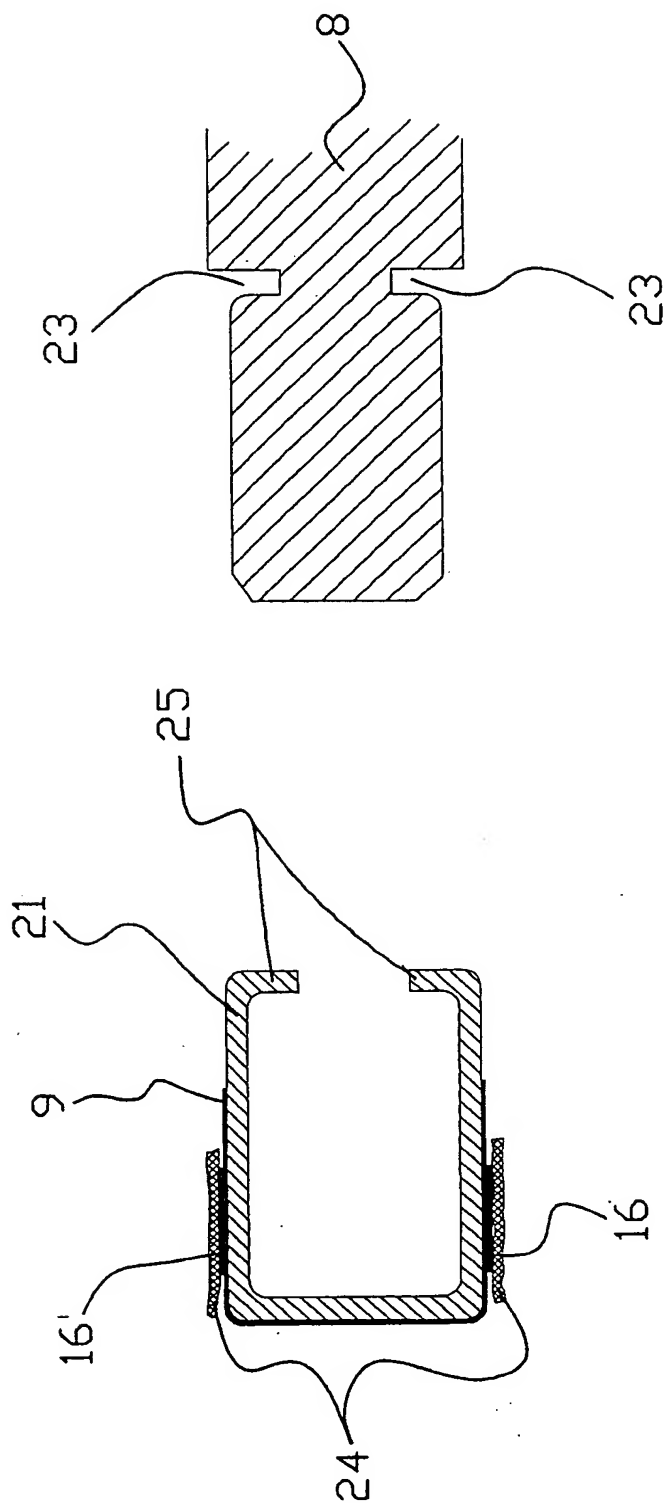


FIG. 9

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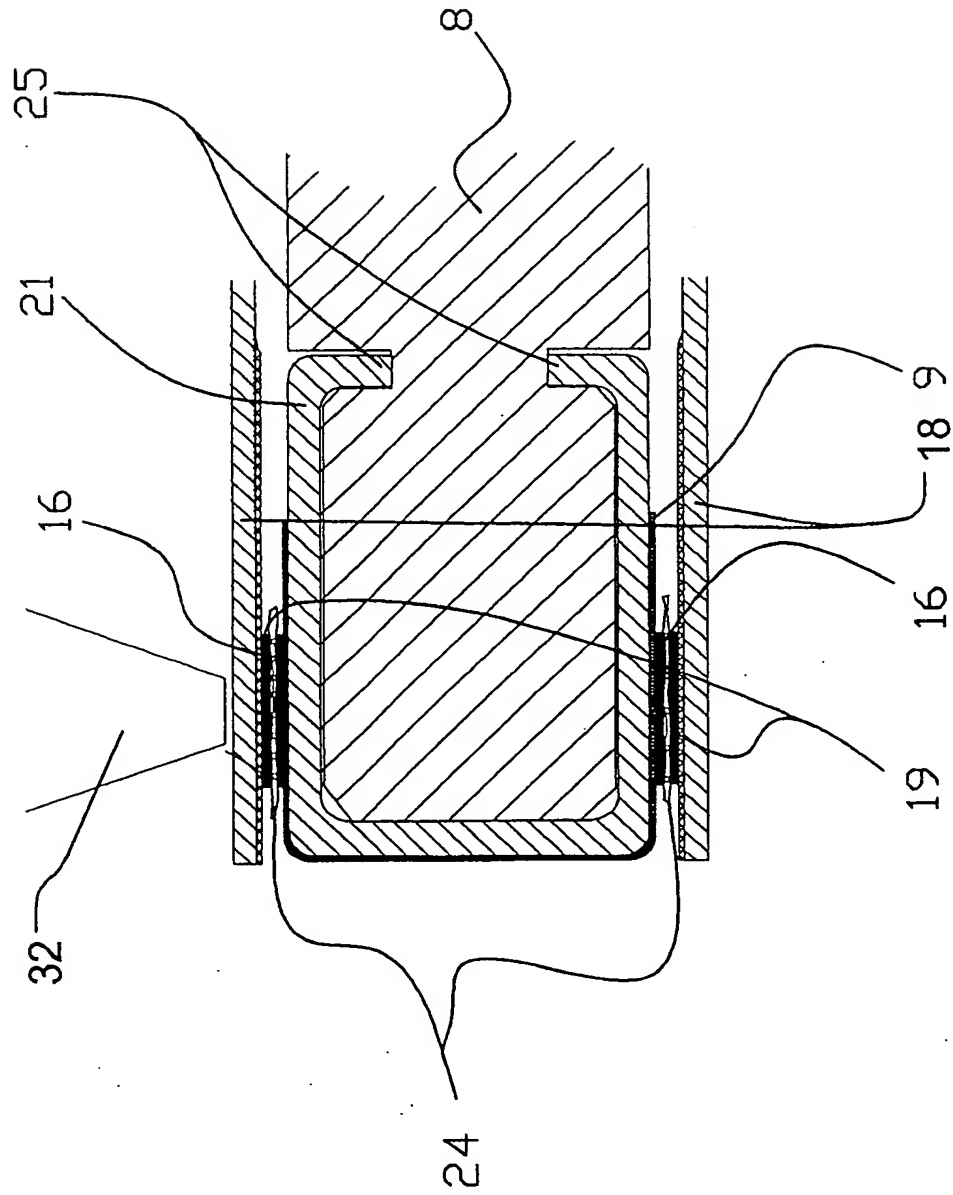


FIG. 10